Naval Facilities Engineering Command

Seismic Hazards Mitigation Program for Facilities Outside of the Continental United States, its Territories and Possessions

March 2000

Contents

Purpose of this Guide

This document provides a step-by-step guide for Commanding Officers and Installation Management Claimants/Regional Commanders for the implementation of a Seismic Hazards Mitigation Program for Navy-occupied Facilities Outside of the Continental United States (OCONUS) (not including US Territories and possessions which are covered by Executive Order 12941). This policy does not include facilities leased by individuals for their private use.

The Seismic Hazards Mitigation Program is designed to provide minimum standards and procedures for the evaluation and mitigation of the seismic hazards in existing and future Navy occupied facilities. The primary objective of this program is to ensure that Navy facilities overseas, whether leased, owned or donated, have the ability to withstand potential seismic events while maintaining the safety of personnel and the continuance of mission critical functions. The program continues with the future addition of facilities to the OCONUS inventory and with changes to an existing facility (such as a use/occupancy change, major modernization or damage to the building) which would trigger seismic evaluation.

Seismic Hazards Mitigation Program

Responsibilities
The activity Commanding Officer (CO) is responsible for the safety of personnel, performance of mission, and the associated seismic risk management. The Installation Management Claimant (IMC)/Regional Commander (RC) is responsible for adopting a programmatic funding strategy, in partnership with the CO, to enable seismic risk assessment and required mitigation. The Naval Facilities Engineering Command is responsible for conducting engineering assessments, assisting the CO and Claimant with development of a programmatic funding strategy, a mitigation strategy, and associated real estate actions, execution of design and construction as needed, and Seismic Hazards Mitigation Program management. The NAVFAC Chief Engineer will manage the overall program with LANTNAVFACENGCOM and PACNAVFACENGCOM providing technical support and data collection management.

The process for the Program is described graphically in Figure 1.

The CO's actions for seismic risk management include the following:
(1) collect data on all facilities and prepare a Seismic Risk Inventory,
(2) in coordination with the IMC/RC, prioritize requirements for Quick Vulnerability Assessments and Detailed Evaluations, prepare scope of work and funding requirements,
(3) submit request for funds to the IMC/RC,
(4) if funds are passed to the CO, request NAVFAC EFD/EFA to perform assessments,
(5) review results of assessments and evaluations with the IMC/RC and NAVFAC EFD/EFA, and

(6) after creation of the initial Seismic Risk Inventory, monitor existing facilities for triggering actions and collect data on all newly purchased, donated or leased facilities for inclusion in the Seismic Risk Inventory.

The IMC/RC actions include the following:

(1) act on the CO's request for funding of Quick Vulnerability Assessments and Detailed Evaluations through development of an integrated funding strategy for all installations reporting to the Claimant,
(2) fund the request for Assessments and Evaluations or request funding as appropriate,
(3) when funds are available, either pass funds to CO or request NAVFAC EFD/EFA preparation of Quick Vulnerability Assessments and Detailed Evaluations,
(4) review the results of the Assessments and Evaluations and develop a programmatic solution with OPNAV and NAVFAC,
(5) after adoption of programmatic solution and funding, tasks EFD/EFA for mitigation actions,
(6) monitors changes in the Seismic Risk Inventory which generate the requirement for a Quick Vulnerability Assessment or a Detailed Evaluation; e.g. future leases/purchases/donations for Navy use, changes in existing building use/occupancy, structural damage or repair/modernization, and
(7) fund mitigation actions or request funding as appropriate.

The Naval Facilities Engineering Command actions include the following (on a reimbursable basis):

(1) support the CO during data collection (creation of web site and download of data), compilation of the Seismic Risk Inventory and assistance in the development of a prioritized list for Quick Vulnerability Assessments and Detailed Evaluations,
(2) perform the Quick Vulnerability Assessments and Detailed Evaluations when requested,
(3) present results from the Assessments and the Evaluations to the IMC/RC and the CO,
(4) assist the IMC/RC and OPNAV in the development of a programmatic solution,
(5) take appropriate real estate and engineering actions to implement mitigation, as requested,
(6) manage the Seismic Hazards Mitigation Program, and
(7) as the assessments are conducted, develop seismic safety brochures (for each activity and surrounding location) to hand out to building occupants and personnel looking for personal property to lease.

OCONUS Seismic Hazards Mitigation Program Process

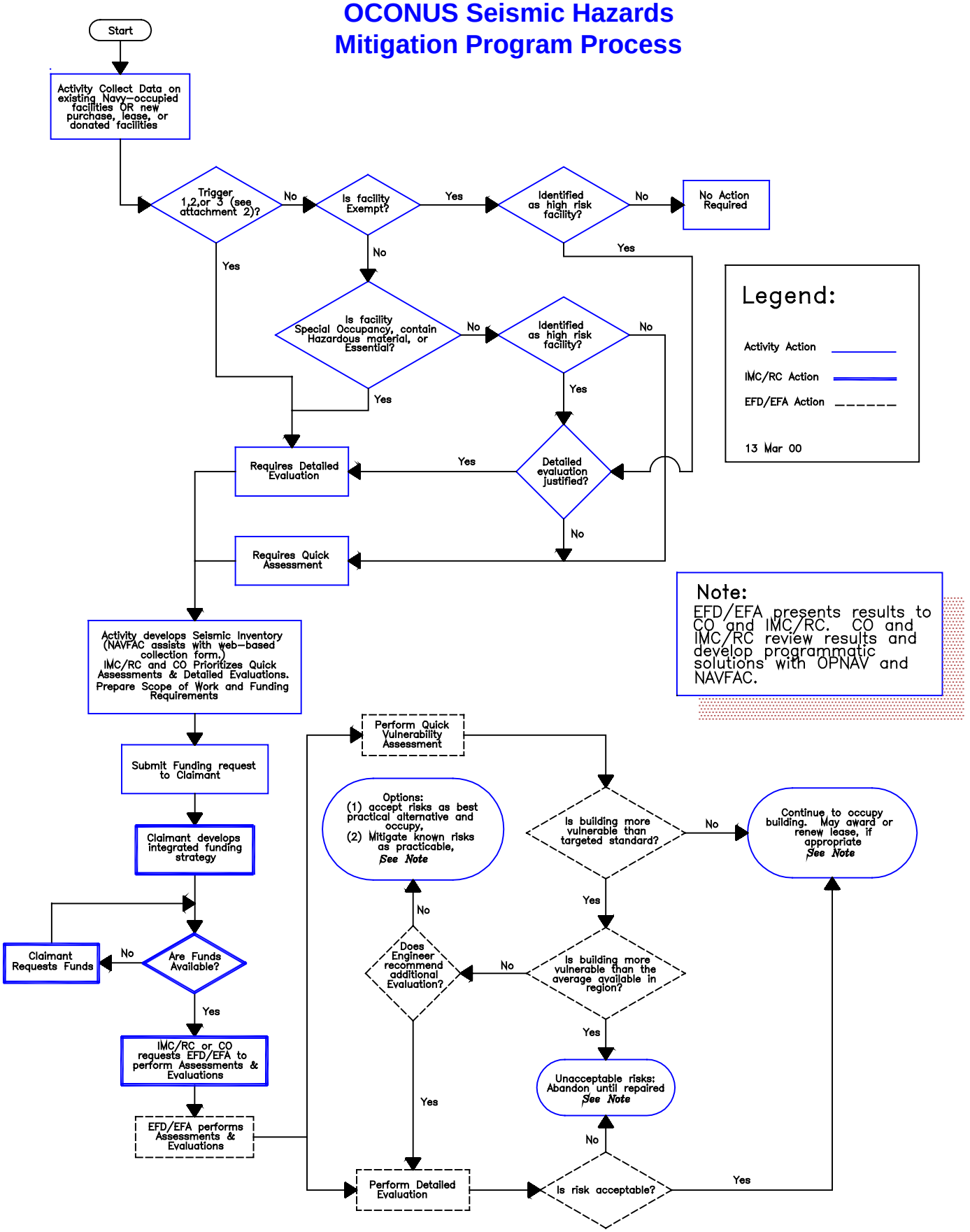

Figure 1.

Data Collection and Creation of Seismic Risk Inventory

The initial action is the collection of data by installation personnel and creation of the Seismic Risk Inventory. All OCONUS Navy-occupied facilities (leased, owned or donated), except privately leased facilities, must be included in the Inventory. The form to be used for the collection of the data on each facility is provided as attachment (1). The data shall be compiled into a Seismic Risk Inventory using a web-based data collection instrument that will allow the compilation of all the data. The "Access Database" software will be used to store all the collected information and to provide data sorted by Activity/Claimant via a download of information to a spreadsheet format. Directions for using the web-based data collection form are as follows:

1. Collect all information on each facility using the Data Collection Form (provided in attachment (1).)
2. Log on to the Internet and go to the LANTDIV Intr**a**net http://lantops.efdlant.navfac.navy.mil OR the PACDIV Intr**a**net http://pacinfo.efdpac.navfac.navy.mil, as applicable.
3. Click on "Seismic Survey Data Collection" Box
4. Fill in all requested information.

The purpose of the Inventory is to identify facilities exempt from further action and to characterize the Use Group category of the facilities to enable prioritization for follow-on assessment. The exemption criteria are shown in attachment (1). The four basic Seismic Use Group categories are as follows: Standard Occupancy Structures, Special Occupancy Structures, Hazardous Facilities, and Essential Facilities. These categories are defined in attachment (1). The NAVFAC EFD/EFA will provide assistance, if needed, in the application of the exemption criteria and development of prioritization for follow-on Quick Vulnerability Assessment and Detailed Evaluation.

If a building is determined to be exempt from the Seismic Hazards Mitigation Program, no further actions are required. If, however, the CO has concerns about the seismic safety of an exempt building, it can be identified as a potential high-risk building and either a Quick Vulnerability Assessment or a Detailed Evaluation conducted.

- **High-Risk Designation**
  CO must consider other factors that may require a seismic assessment on an otherwise exempt building. Examples of these factors include: (1) buildings located near a high occupancy outdoor area (such as playground, athletic field) that would be affected by debris from the building during a seismic event, or (2) remote buildings. See also "High-Risk building" under the Definitions/Glossary section. The NAVFAC EFD/EFA can assist in determining the appropriate evaluation method for identified high-risk buildings.

Assessment of Seismic Risk

The two methods used by the NAVFAC EFD/EFA to gauge the risk to a building from potential seismic activity are the Quick Vulnerability Assessment and the Detailed Evaluation. The approximate cost per facility for the Quick Vulnerability Assessment is $3,000 excluding travel costs. The cost to complete a Detailed Evaluation is between $20,000 and $25,000 per facility. (The actual costs are dependent on several factors including size and complexity of a facility, and the number of similar buildings undergoing assessment, and may vary.)

- **Quick Vulnerability Assessment**

  All non-exempt buildings that are not classified as Special Occupancy Structures, Hazardous Facilities, Essential Facilities or are triggered for a Detailed Assessment require a Quick Vulnerability Assessment (unless identified as high-risk by the CO.) The engineering assessments will establish relative risks in relationship to minimum life-safety standards (Target Vulnerability Score) and the average facilities available in the region (Average Regionally Available Vulnerability Score). Upon receipt of the seismic assessment results, the IMC/RC can develop a programmatic solution for accomplishment of mitigation to reduce risks, if required.

  Development of the Target Vulnerability Score for Standard Occupancy Structures by location: The Target Vulnerability Score for existing Standard Occupancy Structures is intended to be a reasonable estimate of a building's ability to satisfy basic minimum life safety standards. The procedure for determining the Target Vulnerability Score is based upon a rational evaluation of the capacity of the structure; with consideration for both structural and nonstructural elements that contribute to the total lateral load resistance; as compared to the actual forces generated from the potential regional seismic event. The acceptance requirements for existing structures are typically less than that for new U.S. government facilities. This is in recognition that seismic upgrade is an expensive and disruptive process and that it may be cost effective to accept an existing building that is marginally deficient rather than to enforce strict adherence to the criteria.

  The assessments are subjective and sensitive to the interpretation and judgment of the individual performing the assessments. It is therefore necessary that an experienced, licensed professional engineer, knowledgeable in the seismic design of buildings, complete the assessments. It is also highly desirable to complete as many assessments as possible at one time within a geographic region in order to improve the consistency and uniformity of results. Grouping similar structures to the fullest extent possible will reduce the total number of assessments.

- **Detailed Evaluation**

  If a non-exempt building is classified as a Special Occupancy Structure, Hazardous Facility, or Essential Facility, a Detailed Evaluation is required. Detailed evaluations shall be performed in accordance with the requirements of Technical Instruction (TI) 809-05. A Detailed Evaluation may also be required on an exempt or Standard Occupancy building when the CO deems the facility to

be a high-risk facility. Future "Triggering Actions", which are defined in attachment (2), require a detailed evaluation. Detailed Evaluations include conceptual recommendations for the repair of identified deficiencies with associated cost estimates.

Reduction of Seismic Risks

If the Quick Vulnerability Assessments or Detailed Evaluations indicate that there are no substantial seismic risks to a facility, then occupancy can continue without further concern for seismic adequacy. If the results of the evaluation indicate potential vulnerabilities, the risk can be accepted or mitigated through change of occupancy, use of another facility, seismic repair of the facility or construction of a new facility.

In some instances, it may be prudent to accept the risks, either in the short or long term, based upon mission requirements and the lack of practical alternatives. The acceptance of risks should be coupled with mitigation efforts that include: non-structural repairs (brace partitions, entrance canopies, parapets or ceilings; anchor equipment; and/or tie back bookshelves), removal of entrance canopies or parapets, or addition of supports to entrance canopies. It may be desirable to better define the seismic risks with additional evaluation. Buildings with known seismic risks that are occupied should be incorporated into the Activity's Earthquake Response Plan.

Future Triggering Actions for Data Collection and Seismic Evaluations of Existing Navy-occupied Facilities

The program continues for all future facilities related triggering actions. Triggering actions are listed in attachment (2) and can occur at any time during the life of the structure. They are based primarily on a change in status of a facility. When a triggering action occurs, an examination of the seismic risk is required. The identification of a building as a potential high-risk will also require that the building be evaluated for seismic hazards.

New Purchase, Lease or Donation of Navy-occupied Facilities

Purchase, donation or lease of a facility requires screening using the Seismic Hazard Evaluation Program flow chart to determine the seismic status of the facility. The facility should be entered into the Seismic Inventory with the appropriate disposition noted. New facilities may be exempt or require a Detailed Evaluation or a Quick Vulnerability Assessment based upon the Seismic Use Group or specific concerns about an identified high-risk facility.

Points of Contact

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Resources

For copies of all FEMA documents, call FEMA at (800) 480-2520.

(a) TI 809-04, Seismic Design for Buildings, 31 December 1998. For a copy visit: http://www.hnd.usace.army.mil/techinfo/ti/809-04/ti80904.htm.

(b) TI 809-05, Seismic Evaluation and Rehabilitation for Buildings, July 1999. For copy visit: http://www.hnd.usace.army.mil/techinfo/instruct.htm

(c) TI 809-51, Seismic Review Procedures for Existing Military Facilities, 30 September 1999. For copy visit http://www.hnd.usace.army.mil/techinfo/instruct.htm

(d) Standards of Seismic Safety for Existing Federally Owned or Leased Buildings and Commentary, ICSSC RP4/NIST 5382, Feb 1994. For a copy call NIST at (301) 975-6062.

(e) Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Federal Emergency Management Agency (FEMA), FEMA 154, July 1988.

(f) NEHRP Guidelines for the Seismic Rehabilitation of Buildings, FEMA 273, October 1997.

(g) NEHRP Commentary on the Guidelines for the Seismic Rehabilitation of Buildings, FEMA 274, October 1997.

(h) NEHRP Handbook for the Seismic Evaluation of Buildings – A Prestandard, FEMA 310, January 1998.

(i) 1997 Edition, NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (including Maps), Part 1, Provisions, FEMA 302, February 1998.

(j) 1997 Edition, NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, Part 2, Commentary, FEMA 303, February 1998.

Definitions / Glossary

Building Shape Irregularity is a subjective assessment of the geometric shape or features of a structure that could exaggerate the damage due to a seismic event. Types of irregularities include the following:

> **Vertical Irregularity** applies to a discontinuity of strength, stiffness, geometry or mass between sequential floor levels. Examples of this are a lower story which is significantly less stiff than an upper one, columns with partial height infill walls, significant changes from one story to an adjacent one in the size or location of openings in a shear wall, or significant setbacks in the vertical plane of an exterior wall.
>
> **Plan Irregularities** refer to "L", "E", or "T" shaped buildings where the length of the wing projection beyond the reentrant corner is greater that 25 percent of the transverse dimension of the wing.
>
> **Floor/Roof Discontinuities** are considered to be openings in the floor or roof elements of a building, significantly reducing their ability to transfer horizontal seismic forces to the vertical structural elements.

Detailed Evaluations evaluate the seismic risk of an existing facility based upon the guidelines of TI 809-05.

Exemptions are provided for structures that satisfy the requirements of the Seismic Hazards Mitigation Program OCONUS without further assessment or evaluation. For a listing of exemptions see attachment (1).

A **High-Risk Building** is a building that is suspected to be deficient with respect to seismic safety, and potentially pose a significant risk to occupants and / or mission requirements. The determination of High-Risk is based upon several factors including regional seismic potential, occupancy or function, age, type of construction, and location.

Either a quick assessment or a detailed engineering evaluation accomplishes **Measurement of Vulnerability or Risk**. The results of a detailed evaluation should be provided in an engineering report, while the results of a quick assessment are provided using one or more of the following terms:

> **Vulnerability Score (VS)** is a measure of relative seismic vulnerability/ risk to a facility.
>
> **Average Regionally Available Vulnerability Score (ARAVS)** is the measure of seismic vulnerability/risk for buildings potentially available for occupancy in a region.
>
> **Target Vulnerability Score (TVS)** is a measure of seismic vulnerability/risk to a facility in terms of minimum life safety standards.

Mitigation is the substantial reduction of life-safety risk from seismic hazards involving a building and/or building site. Examples include demolition, permanent evacuation, a change in occupancy, and/or repair.

For the purpose of this document, **OCONUS** applies to all regions outside of the United States as defined in the Earthquake Hazards Reduction Act of 1977, as amended. As defined, the United States includes, the District of Columbia, and any territory or possession of the United States.

Repair is the removal, replacement, strengthening, or protection of all structural elements that are identified as deficient during a building evaluation.

Quick Vulnerability Assessments utilize a process to quickly assess the seismic vulnerability of a facility relative to minimum life safety standards and to the risk to similar facilities available in the region**.**

Seismic Hazards Mitigation Program OCONUS is designed to identify and reduce the life-safety and operational risks from seismic hazards to occupied facilities OCONUS.

Seismic Hazard Potential is a level of potential earthquake effects based upon best available information (see attachment (3)).

> **Low** Regions of relatively low seismic hazard potential, roughly equivalent to seismic Zones 0 and 1 as defined in previous Navy design manuals.
>
> **Moderate** Regions of relatively moderate seismic hazard potential, roughly equivalent to seismic Zones 2A and 2B as defined in previous Navy design manuals.
>
> **High** Regions of relatively high seismic hazard potential, roughly equivalent to seismic Zones 3 and 4 as defined in previous Navy design manuals.

Seismic Risk Inventory is an inventory of all buildings under the jurisdiction of Command, Region, or Installation Management Claimant in order to comply with the Seismic Hazards Mitigation Program OCONUS.

Seismic Use Group is a classification assigned to a building based on its use and occupancy. See Attachment (1) for detailed examples.

> **Essential Facilities** are buildings required for post-earthquake recovery, or having mission-essential functions that are absolutely critical to mission continuation with no redundant back-up.
>
> **Hazardous Facilities** are buildings containing substantial quantities of hazardous substances that could be dangerous to the safety of the general public if released.
>
> **Special Occupancy Structures** are buildings that constitute a substantial hazard due to the occupancy or use.
>
> **Standard Occupancy Structures** are all other buildings not defined by any other Seismic Use Group.

Triggering Actions cause an activity to examine a facility's seismic vulnerability.

Seismic Risk Inventory - OCONUS - Data Collection Form

Owner ID

Base _____ Country _____ Claimant _____

Building ID

Bldg No. _____ No. of Stories _____
On Base ☐ or Off Base ☐ Total Bldg Area: _____ SF
Year Built: _____ Bldg Shape: Regular ☐ , Irregular ☐
Primary Category Code _____ No. of Occupants _____

Exemptions from Seismic Evaluations

(see back of this Form for details on Exemptions)
(1) U.S. Code or equivalent ☐, (2) Compliance by Assessment and/or Rehab ☐ ,
(3) Incidental Occupancy or < 2 hrs/day ☐, (4) <3000 SF Light Frame ☐,
(5) <10,000 SF in low EQ region ☐, (6) Vacated in 5 years ☐, (7) NONE ☐

Seismic Use Group

(see back of this Form for list of Use Groups)
(I) Standard ☐, (II) Special ☐, (III-H) Hazardous ☐, (III-E) Essential ☐

Function and Occupancy of Structure

(see back of this Form for details on Use Groups)
(**I**) Standard ☐, (**II-1**) Gathering ☐, (**II-2**) Daycare ☐, (**II-3**) Ed bldg ☐, (**II-4**) BQ ☐,
(**II-5**) Med ☐, (**II-6**) Jails ☐, (**II-7**) Water ☐, (**II-8**) High Value Equipment ☐,
(**III-H**) Hazardous ☐, (**III-E-1**) Emergency ☐, (**III-E-2**) Mission ☐
For III-E, Specify use: _____

Determination of High Risk by Commanding Officer:

(ONLY ANSWER THIS QUESTION IF THIS IS AN EXEMPT OR USE GROUP I BUILDING) Does the CO consider this a high-risk building? YES☐ NO ☐ NA ☐

Leased Building Data

Is Bldg Leased? Yes ☐ No ☐ Size of Lease: _____SF
Current Lease Expires (Date) _____
Lease Renewal Options Through (Date) _____
Anticipated occupancy required for? 1 year ☐, less than 5 years ☐,
greater than 5 years ☐, Indefinitely ☐

Disposition

Exempt ☐, Quick Assessment ☐, Detailed Evaluation ☐ (see Program Guide)

Data Collection

Entered by & Date: _____Reviewed by & Date:_____

Attachment (1) – Side 1

(See Side 1 for data to be collected)

Exemptions to Seismic Hazards Mitigation Program – OCONUS

(See Attachment (3) for Seismic Hazard Potential for selected locations)

(1) Buildings constructed in accordance with standards NAVFAC P-355, "Seismic Design for Buildings", Feb 1982 (based on U.S. Codes) or equivalent standard, with the exception of steel moment framed structures which shall not be exempt,
(2) Buildings which have already been seismically evaluated or assessed and have been rehabilitated, or determined to be in compliance with the seismic standards,
(3) "Standard Occupancy" buildings intended only for incidental occupancy, or occupied by persons for a total of less than 2 hours a day,
(4) With the exception of "Hazardous and Essential Facilities", one-story buildings of steel light frame or wood construction with areas less than 3000 ft^2 (280 m^2) in all regions of Seismic Hazard Potential,
(5) "Standard Occupancy" buildings with **Navy-occupied space** less than 10,000 ft^2 (930 m^2) and located in regions of Low Seismic Hazard Potential, or
(6) Buildings that the Navy will not occupy beyond 5 years.

Seismic Use Groups

Seismic Use Group	Function & Occupancy of Structure
(I) Standard Occupancy Structures	All structures having occupancies or functions not listed below.
(II) Special Occupancy Structures	(II-1) Covered structures whose primary occupancy is public assembly with a capacity greater than 300 persons.
	(II-2) Daycare centers with a capacity greater than 150 persons.
	(II-3) Educational buildings with a capacity greater than 250 persons or 465 m^2 (5,000 ft^2) classroom space.
	(II-4) Barracks and BOQs / BEQs with capacity greater than 200 persons.
	(II-5) Medical facilities with 50 or more resident incapacitated patients
	(II-6) Jails and detention facilities.
	(II-7) Water &Wastewater treatment facilities required for primary treatment.
	(II-8) Facilities having high value equipment
(III-H) Hazardous Facilities	Structures housing, supporting or containing sufficient quantities of toxic or explosive substances to be dangerous to the safety of the general public if released.
(III-E) Essential Facilities	(III-E-1) Emergency and post disaster recovery facilities such as hospitals, fire and police stations, communications centers, security, etc.
	(III-E-2) Mission essential facilities absolutely critical to mission continuation of the activity (there is no redundant back up facility on or off site).

Triggering Actions for Seismic Evaluation

(1) A change in a building's function which increases the Seismic Use Group classification from (I) to (II) or (III); or from (II) to (III) (see attachment (1) for Use Group classification definitions),

(2) A repair or alteration project that costs more than 50 percent of the replacement value of a building, or

(3) Damage to the lateral or vertical load carrying capability of a building by fire, wind, earthquake or other causes.

Seismic Hazard Potential for Selected Locations

Installation Management Claimant	Location	Seismic Hazard Potential
LANTFLT		
	Keflavik, Iceland	High
CINCUSNAVEUR		
	London, England	Moderate
	St. Mawgan, England	Moderate
	Rota, Spain	Moderate
	Souda Bay, Greece	High
	La Maddalena, Italy	Low
	Sigonella, Italy	High
	Gaeta, Italy	Moderate
	Naples, Italy	Moderate
	Cairo, Egypt	Moderate
	Lisbon, Portugal	High
PACFLT		
	Bahrain, Saudi Arabia	Low
	Diego Garcia	High
	Singapore	Low
	Okinawa/Camp Shields, Japan	High
	Atsugi, Japan	High
	Yokosuka, Japan	High
	Misawa, Japan	High
	Iwakuni, Japan	High
	Sasebo, Japan	High
	Chinhae, Korea	Low
	Seoul, Korea	Low